RESPONSE OF *TYPHA ANGUSTIFOLIA* L. PHYTOREMEDIATION IN ACID MINE DRAINAGE (AMD) AT EX-MAMUT COPPER MINE, RANAU, SABAH, MALAYSIA

LO VUN YEN

INSTITUTE FOR TROPICAL BIOLOGY AND CONSERVATION
UNIVERSITI MALAYSIA SABAH

2017

RESPONSE OF *TYPHA ANGUSTIFOLIA* L. PHYTOREMEDIATION IN ACID MINE DRAINAGE (AMD) AT EX-MAMUT COPPER MINE, RANAU

LO VUN YEN

THESIS SUBMITTED IN FULFILLMENT FOR THE DEGREE OF MASTER OF SCIENCE

INSTITUTE FOR TROPICAL BIOLOGY AND CONSERVATION
UNIVERSITI MALAYSIA SABAH

2017

ABSTRACT

Typha angustifolia L. was planted *in situ* at Ex-Mamut copper mine at Ranau, Sabah. The planting area receives continuous water flow from the mine pit. The growth and the accumulation of heavy metals in *T. angustifolia* as well as its anatomical were examined to study the potential of *T. angustifolia* as phytoremediation in acid mine drainage (AMD). The concentrations of heavy metals in three replicates of plant roots, stems and leaves were determined at 0, 60, 90 and 120 days after planting. The samples of plant tissue analysed by Inductively-Coupled Plasma Emission Spectrometry showed that the highest concentration of iron (15.33 mg/g) was in the root tissues at Day 120 followed by leaves (0.23 mg/g) and stems (0.21 mg/g). The translocation factor values of heavy metals were less than 1, which indicated that the translocation of heavy metals from roots to stem and leaves was not effective. The plant roots were necrosis and the leaves were chlorosis, but the new shoots were grown out at the end of experiment. The analysis of the root surfaces by Scanning Electron Microscope-Energy Dispersive X-ray spectrometry showed that the highest percentage of heavy metal was iron (23.8wt%). A light microscopic study showed the distortion of cell shape in the root. A Transmission Electron Microscope study showed that some granules were deposited around root cell walls. The result shows that *T. angustifolia* can survive in acidic environments such as at Mamut mine and has characteristics of an excluder species. The results obtained from this research can be used to maximize the potential of *T. angustifolia* for phytoremediation at Ex-Mamut copper mine.

Keywords: *Typha angustifolia*, acid mine drainage, heavy metals, phytoremediation

ABSTRAK

REAKSI TYPHA ANGUSTIFOLIA L. SEBAGAI FITOREMEDIASI DALAM SALIRAN ASID LOMBONG DI BEKAS LOMBONG TEMBAGA MAMUT, RANAU, SABAH, MALAYSIA.

Typha angustifolia L. ditanam secara in situ di bekas lombong tembaga Mamut di Ranau, Sabah. Kawasan penanaman menerima aliran air secara berterusan dari lubang utama bekas lombong. Pertumbuhan and pengumpulan logam berat dalam tumbuhan sekali dengan anatominya telah dikaji untuk kaji potensi T. angustifolia sebagai fitoremediasi di saliran asid lombong. Penentuan kepekatan logam berat bagi setiap tiga replikat akar, batang dan daun telah dilakukan pada hari-0, hari-60, hari-90 dan hari-120 selepas penanaman. Analisis sampel tisu tumbuhan pada hari-120 dengan menggunakan Inductively-Coupled Plasma Emission Spectrometry menunjukkan besi adalah kepekatan tertinggi (15.33 mg/g) pada tisu akar diikuti oleh daun (0.23 mg/g) dan batang (0.21 mg/g). Nilai faktor translokasi logam berat adalah kurang daripada 1, dimana ini bermakna translokasi logam berat dari akar ke batang dan seterusnya ke daun adalah tidak berkesan. Akar tumbuhan telah nekrosis dan daunnya warna kuning, tetapi anak tumbuhan baru telah tumbuh di akhir experiment. Analisis permukaan akar dengan menggunakan Scanning Electron Microscope-Energy Dispersive X-ray spectrometry menunjukkan peratusan logam berat tertinggi adalah besi (23.8 wt%). Kajian cahaya mikroskop menunjukan bentuk sel akar diputarbelitkan. Kajian Transmission Electron Microscope menunjukkan tumpukan beberapa butiran di sekeliling dinding sel akar. Keputusan kajian menunjukkan T. angustifolia menunjukkan ciri spesies penyingkiran dan boleh bermandiri dalam persekitaran berasid seperti bekas lombong Mamut. Hasil daripada kajian ini boleh digunakan untuk memaksimalkan potensi T. angustifolia untuk tujuan fitoremediasi bekas lombong tembaga Mamut.